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(71) Applicant (for all designated States except US):
ZANDERS FEINPAPIERE AG [DE/DE]; An der
Gohrsmühle, 51465 Bergisch Gladbach (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **BECKER, Franz,**
Josef [DE/DE]; Schützheide 17, 51465 Bergisch Gladbach
(DE). **UERLINGS, Viktor [DE/DE];** Frankenstrasse 73,
52351 Düren (DE).

(74) Agent: **STERNAGEL, FLEISCHER, GODEMEYER**
& PARTNER; Braunsberger Feld 29, 51429 Bergisch
Gladbach (DE).

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(54) Title: **PATTERNED PAPER**

(57) Abstract: The present invention relates to a process for the production of nonuniformly intensely colored paper, and paper produced by this process. The process comprises: (a) application of at least one surfactant or a mixture of surfactants in the forms of a latent image or pattern to paper, (b) coloring of the paper by means of a dye solution and (c) drying of the colored paper.

WO 03/012202 A1

Patterned paper

The present invention relates to a process for the production of nonuniformly intensely colored paper, and the paper produced by
5 this process.

Even in the age of electronic data transmission, there is in general a need for visually appealing papers. It is therefore an objective of the paper industry to produce papers which have an
10 appealing visual effect in addition to high paper quality.

In US 4,534,157, a paper is printed in color in the moist state directly after its production as a paper web, by applying ink via ink nozzles onto an inking roller which then transfers the ink to
15 the paper. Thus, an irregular, diffuse pattern with an ink quantity which remains constant over the paper web is applied to otherwise uncolored paper.

In EP 601 517, white paper is printed in regular or irregular patterns with as little ink as possible. The ink penetrates only to a small extent into the paper. The disclosure of EP 601 157 attaches particular value to the small penetration of the ink into the paper, since the paper is subsequently to be recyclable as white paper. The ink should therefore be capable of being easily
20 removed from the paper.
25

EP 681 060 describes a process for the production of a differently colored paper, in which cellulose fibers and agglomerates of different thickness are used in the process for the production of the paper and are deposited on or incorporated into the finished paper. The cellulose fibers or agglomerates of different thickness are colored before the deposition on or incorporation into the paper, and are then introduced into the paper pulp, which itself may have a different color.
30

The methods used to date for the production of patterned papers are either complicated or slow in the production method or lead to papers which achieve a completely different effect.
35

EP 439 363 discloses a paper which contains a desizing agent or is coated therewith, with the result that better absorption of the ink during the printing of the paper by means of inkjet printing is achieved. The desizing agent is distributed in/on this paper, uniformly over the entire paper surface, in order to obtain an optimum printed copy.

EP 518 490 describes ink which is used for inkjet printing, the ink containing a composition which facilitates the penetration of the ink into the printed paper.

Common to the teachings of EP 439 363 and EP 518 490 is that the penetration of polar liquids, such as inkjet inks, into the paper structure and into the paper fibers of sized paper is facilitated by the suitable use of a desizing agent. However, neither EP 439 363 nor EP 518 490 describes the production of patterned paper by nonuniform coloring of the paper surface.

It was an object of the present invention to obtain a visually appealing paper of nonuniform coloring with as little production effort as possible.

This object is achieved by a process for the production of nonuniformly intensely colored paper, comprising

- a) application of at least one surfactant or a mixture of surfactants in the form of a latent image or pattern to paper,
- b) coloring of the paper by means of a dye solution and
- c) drying of the colored paper.

The invention makes use of the phenomenon of paper sizing and the possibility of subsequently manipulating this in a specific manner in preferred regions on the paper web by applying suitable substances. Papers are as a rule sized for the purpose of avoiding excessive penetration of applied liquids into the paper structure

and into the fibers (blotter effect). This is effected during the paper production by adding sizing substances to the aqueous paper fiber slurry before this is shaped into a paper web in the paper machine. The sizing substances are deposited on the fibers to the extent to which the property of liquid absorption of the finished dry paper is desired. This process is known as internal sizing or engine sizing. The achieved extent of liquid absorption is inversely proportional to the "degree of internal sizing" of the paper.

Surface sizing can be carried out instead of or in addition to engine sizing. Here, film-forming substances, such as solutions or dispersions of converted starches, gums and modified polymers, are applied to the already shaped paper web, for example by means of size presses inside the paper machine. The surface sizing also contributes to the strength of the paper, so that high-quality printing paper frequently has engine size and surface size. The presence of a surface size is, however, not essential for the process according to the invention, and it is also possible to use paper which has no surface size.

Alternatively, the process for the production of nonuniformly intensely colored paper in step a) may comprise the application of a dye solution in the form of a visible image or pattern to paper.

Preferred embodiments of the invention are stated in the subclaims.

The production process according to the invention leads to a paper which is solidly colored, the intensity of the color differing within the paper surface. The different intensity of the color results in a visual effect which appears as an image or pattern to the eye.

The image or pattern may be present in the form of a representative image, an imaginative structure, a signet, a regular or irregular pattern, a net structure or an irregular, for example random, distribution of the color on the paper.

The image or pattern can be applied either directly after papermaking, i.e. to the still moist paper, or to a previously produced, dried paper, the paper then being solidly colored by means of an aqueous dye solution. The image or pattern can be applied to a continuous paper web or to individual paper sheets. Preferably, the image or pattern is applied to a continuous paper web.

The image or pattern can be applied by any desired method, in particular by inkjet printing, offset printing, flexographic printing, gravure printing, printing with felt or rubber rollers, by spraying on or manually, the last method being unsuitable for industrial production. Particularly preferred application methods for the image or pattern is application by means of inkjet printing, flexographic printing or gravure printing.

The pattern or image is applied either in the form of a latent image or pattern or in the form of a visible image or pattern to the paper.

For the creation of a latent image or pattern, a substance which influences the penetration of an aqueous dye solution into the paper at the point at which the substance is applied by either facilitating or reducing the absorption, is applied to the paper.

This is achieved by reducing (desizing agent) or increasing (water repellent), by means of the applied substance, the degree of sizing or degree of water repellency achieved by the paper sizing.

Every substance which has this property can be used for the process according to the invention. Surfactants are preferably used for this purpose. Anionic, cationic, nonionic or amphoteric surfactants may be used. In addition to the surfactants, it is possible to use substances which facilitate the penetration of dyes into the paper. Such substances are, for example, glycol ethers, such as ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monophenyl ether, diethylene

glycol monomethyl ether, diethylene glycol monoethyl ether and diethylene glycol monobutyl ether.

- Suitable desizing surfactants can be selected, for example, from
- 5 (1) hydrophilic polydialkylsiloxanes, (2) polyalkylene glycol, (3) polypropylene oxide/polyethylene oxide copolymers, (4) fatty ester-modified compounds of phosphate, sorbitan, glycerol, polyethylene glycol, sulfosuccinic acids, sulfonic acid or alkylamine, (5) polyoxyalkylene-modified compounds of sorbitan
 - 10 esters, fatty amines, alkanolamides, castor oil, fatty acid, fatty alcohol, (6) quaternary alcohol sulfate compounds, (7) fatty imidazolines, (8) polyether-modified trisiloxanes and (9) mixtures thereof.
- Specific examples of water- or alcohol-soluble desizing agents from the abovementioned classes of substances are, for example, (1)
- 15 poly(oxyalkylene) modifications of (a) sorbitan esters (e.g. Alkamuls PSML-4 (poly(oxyethylene)sorbitan monolaurate), Alkamuls PSMO-20 (poly(oxyethylene)sorbitan monooleate), Alkamuls PSTO-20
 - 20 (poly(oxyethylene)sorbitan trioleate), Alkaril Chemicals); (b) fatty amines (e.g. Alkaminox T-2, T-6 (tallow amine oxyethylate), Alkaminox SO-5 (soybean amine oxyethylate), Alkaril Chemicals), (Icomeen T-2, Icomeen T-15, ICI Chemicals); (c) castor oil (e.g. Alkasurf CO-10, Alkasurf CO-25B (castor oil oxyethylates), Alkaril
 - 25 Chemicals); (d) alkanolamide (e.g. Alkamide C-2, C-5 (coconut oil alkanolamide oxyethylates), Alkaril Chemicals); (e) fatty acids (e.g. Alkasurf 075-9, Alkasurf 0-10, Alkasurf 0-14 (oleic acid oxyethylates), Alkasurf L-14 (lauric acid oxyethylates), Alkasurf P-7 (palmitic acid oxyethylates), Alkaril Chemicals); (f) fatty
 - 30 acid alcohol (e.g. Alkasurf LAN-1, LAN-3, Alkasurf TDA-6, Alkasurf SA-2 (linear alcohol oxyethylates), Alkasurf NP-1, NP-11, Rexol 130 (nonylphenol oxyethylates), Alkasurf OP-1, OP-12 (octylphenol oxyethylates), Alkasurf LA-EP-15, Alkasurf LA-EP-25, Alkasurf LA-EP-65 (linear alcohol oxyalkylates)); (2) hydrophilic
 - 35 poly(dimethylsiloxanes), such as, for example, (a) poly(dimethylsiloxane) provided with a monocarbinol terminal group (PS556, Petrarch Systems Inc.) and poly(dimethylsiloxane) provided

with a dicarbinol terminal group (PS555, PS556, Petrarch Systems Inc.); (b) poly(dimethylsiloxane)-b-poly(methylsiloxane/ alkylene oxide) copolymers (PS 073, PS 072, PS 071, Petrarch Systems Inc.), Alkasil HEP 182-280, Alkasil HEP 148-330 (Alkaril Chemicals),
5 nonhydrolyzable copolymers containing Si-C bonds; (c) poly(dimethylsiloxane)-b-poly(propylene oxide)-b-poly(ethylene oxide) copolymers (Alkasil NEP 73-70, Akaril Chemicals), a hydrolyzable copolymer containing Si-O-C bonds; (d) polyquaternized poly(dimethylsiloxane) copolymers (which can be obtained by the
10 addition reaction of an α,ω -hydrogenpolysiloxane with epoxides containing olefinic bonds and subsequent reaction of the product with a diamine); (3) fatty imidazolines and their derivatives, such as, for example, (a) Alkazine-0 (oleyl derivative); (b) Alkazine TO (tall oil derivative); (c) Alkateric 2C1B (dicarboxylic acid
15 coconut imidazoline sodium salt), Alkaril Chemicals; (d) Arzoline-4; (e) Arzoline-215, Baker Chemicals; (4) fatty acid esters of (a) phosphates (e.g. Alkaphos B6-56A, Alkaril Chemicals); (b) sorbitan (e.g. Alkamuls STO (sorbitan trioleate), Alkamuls SML (sorbitan monolaurate), Alkamuls SMO (sorbitan monooleate), Alkaril
20 Chemicals); (c) glycerol compounds (e.g. Alkamuls GMO-45LG (glyceryl monooleate), Alkamuls GDO (glyceryl dioleate), Alkamuls GTO (glycerol trioleate); (d) poly(ethylene glycols) (Alkamuls 600 DO (dioleate), Alkamuls 400-ML (monolaurate), Alkamuls 600 MO (monooleate), Alkamuls 600 DL (dilaurylate), Alkamuls 600 DT
25 (ditallow), Alkaril Chemicals); (e) sulfosuccinic acid (e.g. Alkasurf SS-0-75 (sodium dioctylsulfosuccinate), Alkasurf SS-DA4-HE (oxyethylated alcohol sulfosuccinate), Alkasurf SS-L7DE (sodium sulfosuccinate ester of lauric acid diethanolamide), Alkasurf SS-L-HE (sodium laurylsulfosuccinate), Alkaril Chemicals); (f) sulfonic
30 acid (e.g. Alkasurf CA (calcium dodecylbenzenesulfonate), Alkasurf IPAM (isopropylamine dodecylbenzenesulfonate), Alkaril Chemicals); (g) alkylamines (e.g. Alkamide SDO (soybean diethanolamide), Alkamide CDE (coco-diethanolamide), Alkamide 2104 (coconut fatty acid diethanolamide), Alkamide CMA (coco-monoethanolamide),
35 Alkamide L9DE (lauryldiethanolamide), Alkamide L7Me (lauryl-monoethanolamide), Alkamide LIPA (laurylmonoisopropylamide), Alkaril Chemicals); (5) quaternary compounds, such as, for example,

(a) nonpolymeric quaternized ammonium ethosulfate (e.g. Finquat CT, Cordex T-172, Finetex Corporation); (b) quaternary dialkyldimethyl methosulfate (e.g. Alkaquat DHTS (hydrogenated tallow)); (c) alkoxyated quaternized di-fatty methosulfate (e.g. Alkasurf DAET (tallow derivative)); (d) quaternized fatty imidazoline methosulfate (e.g. Alkaquat T (tallow derivatives), Alkaril Chemicals); (6) water-soluble copolymers of lipophilic poly(propylene oxide) with hydrophilic poly(ethylene oxide), such as, for example, (a) methanol-soluble Tetronic 150R1, Pluronic L-101, Tetronic 902, Tetronic 25R2 (BASF Corporation), Alkatronic EGE-1 (Alkaril Chemicals); (b) water-soluble Tetronic 908, 50R8, 25R8, 904, 90R4, Pluronic F-77, all from BASF Corporation, and Alkatronic EGE 25-2 and PGP 33-8 from Alkaril Chemicals; (7) poly(alkylene glycol) and its derivatives, such as, for example, (a) polypropylene glycol (Alkapol PPG 425, Alkapol PPG-4000, Alkaril Chemicals); (b) poly(propylene glycol dimethacrylate), poly(ethylene glycol diacrylate), poly(ethylene glycol dimethacrylate), poly(ethylene glycol monomethyl ether), poly(ethylene glycol dimethyl ether), poly(ethylene glycol diglycidyl ether) (all from Polysciences); (c) poly(1,4-oxybutylene glycol) (Scientific Polymer Products) and the like.

Preferred desizing agents include linear alcohol oxyethylates (e.g. Alkasurf LA-EP-65, LA-EP-25 and LA-EP-15 obtainable from Alkaril Chemicals), nonylphenol oxyethylates (e.g. Alkasurf NP-11 obtainable from Alkaril Chemicals and Rexol 130 obtainable from Hart Chemicals), octylphenol oxyethylates (e.g. Alkasurf OP-12 obtainable from Alkaril Chemicals), oleic acid oxyethylates (e.g. Alkasurf O-14 obtainable from Alkaril Chemicals), poly(dimethylsiloxane)-b-poly(propylene oxide)-b-poly(ethylene oxide) copolymers (e.g. Alkasil NEP 73-70 obtainable from Alkaril Chemicals), castor oil oxyethylates (e.g. Alkasurf C025B obtainable from Alkaril Chemicals), coco-imidazolinedicarboxylic acid sodium salts (e.g. Alkateric 2C1B obtainable from Alkaril Chemicals) and coconut fatty acid diethanolamide (e.g. Alkamid S104 obtainable from Alkaril Chemicals). The Alkasurf desizing agents are advantageously biodegradable.

Suitable surfactants imparting water repellency are, for example, paper sizes, such as alkylsuccinic anhydride (ASA), alkylketene dimer (AKD) and polyolefins (e.g. SÜDRANOL 200, Süddeutsche Emulsions-Chemie GmbH, Mannheim, Germany), waxes, wax-like substances, metal soaps (stearates), paraffin and paraffin emulsions, fatty acids, fatty acid (methyl) esters, fatty alcohols, fatty alcohol polyglycol ethers and the sulfates thereof.

During application to the paper, the surfactants are present in the form of solutions, emulsions or dispersions, which further may contain soluble dyes as mentioned below, and/or further auxiliaries in addition to surfactants. Conventional auxiliaries are thickeners, such as, for example, gum arabic, polyacrylates, polymethacrylates, polyvinyl alcohols, hydroxypropylcellulose, hydroxyethylcellulose, polyvinylpyrrolidone, polyvinyl ether, starch, polysaccharides and the like, optical brighteners, brightener quenchers, pigments (dying or non-dying pigments, including pigments with a metallic effect or metals), binders, preservatives and safety chemicals, such as, for example, fluorescent, phosphorescent or luminescent substances. The surfactants are preferably present as an aqueous or alcoholic solution.

The concentration ranges for the surfactants in the solutions, emulsions or dispersions to be applied are 0.01 to 30% by weight, preferably 0.1 to 25% by weight, particularly preferably in the range from 0.2 to 15% by weight.

The concentrations of the thickeners which can be used as surfactant auxiliaries are in the range from 0 to 5% by weight, preferably 0.01 to 2.5% by weight, particularly preferably 0.05 to 2.5% by weight, of the total solution, emulsion or dispersion.

In order to achieve a further special effect on the finished paper, desizing and water repellency-imparting surfactants may also be applied side by side on the same paper surface.

Any desired dye solution can be used for creating a visible image or pattern. An aqueous solution of substantive, basic or acidic dyes, or a mixture of these dyes, is preferably used. Examples of suitable dye solutions are customary printing inks which contain, for example, anthraquinone-, monoazo-, diazo-, phthalocyanine-, aza-(18)-annulene- and formazan-copper complex dyes. Examples of suitable dyes are those mentioned further below for the dye solution of the dyeing bath, including dyes containing or based on pigments as mentioned below.

The concentration ranges of the dyes are 0.1 to 30% by weight, preferably 1.0 to 20% by weight, particularly preferably 2.0 to 10% by weight.

The latent or visible image or pattern can be applied to one side or both sides of the paper so that the finished paper has, at least on one side, a color which is more intense or less intense than in the untreated regions of the paper surface(s).

After the application of the latent or visible image or pattern to the paper, the paper is solidly colored in step (b) with the aid of a dye solution. This coloring is effected so as to cover the whole area, either inside or outside the paper machine, by applying dye solution(s) to the paper by means of classical paper coating apparatuses and processes, such as, for example, a size press, film press, knife coater, blade, rolls or spraying, or by application of a dye solution to the total surface of the paper with the aid of suitable printing methods, such as inkjet printing, offset printing, flexographic printing, gravure printing or printing by means of felt or rubber rollers, by spraying on or by tub coloring of the paper in a dyeing bath. It is preferable to color the paper by the dip process in an aqueous dye solution.

Any dye solution commercially available for these purposes can be used in the present invention. The dye solution usually contains the dyes in concentration ranges of 0.1 to 40% by weight, preferably 0.1 to 35% by weight, very particularly preferably 0.1

- 10 -

to 30% by weight. The concentration of the dye solution can be established according to the individually desired effect to be achieved (intensity of the subsequently desired image). Corresponding experiments can be carried out by any person skilled
5 in the art by simple testing.

In the dip process, the paper is immersed in an aqueous dye solution after application of the latent or visible image or pattern and is then pressed off and dried. Tub coloring can be
10 carried out using sized or unsized paper webs or paper sheets. By means of tub coloring, it is possible to obtain rich colors of very high luminous power. A further advantage of this method is that even small amounts can be colored without operating inefficiently.

15 If a latent image was applied before the coloring of the paper, the paper absorbs the color to a greater or lesser extent in the pretreated areas during the coloring process, depending on the substance with which the paper was pretreated.

20 The stronger acceptance of the ink in regions which were pretreated with a desizing agent gives the paper on which the image or pattern initially applied in latent form appears in a more intense hue of the same color in which the entire paper is
25 colored. Thus, the color intensity of the image or pattern subsequently appearing as "positive" can be varied by the applied amount and/or composition of the desizing agent applied.

30 If a water repellent is applied before the coloring of the paper, the image or pattern initially applied in latent form appears, after the coloring of the paper, in a less intense hue of the same color in which the entire paper is colored. Here too, the color intensity of the image or pattern subsequently appearing as
35 "negative" can be varied by the applied amount and/or composition of the water repellent applied.

For the production of the latent image, it is also possible to apply desizing and water-repellent substances side by side on the

same paper surface, so that the finished paper has both "positive" and "negative" images or patterns.

5 In order to obtain one of the effects described so far, it is essential to carry out the coloring of the paper after the application of the substance influencing the ink absorption.

10 If a visible image or pattern is applied before the coloring of the paper, the subsequent coloring of the paper intensifies the color of the previously applied image or pattern, so that a special effect, namely the nonuniformly intense coloring of the paper, can also be achieved thereby. This effect can be obtained only if the paper carrying the visible image is additionally colored.

15 Customary aqueous dye solutions can be used for coloring the paper. These may contain basic and/or acidic and/or substantive dyes. Examples of suitable dye solutions are solutions which contain anthraquinone-, monoazo-, diazo-, phthalocyanine-, aza-
20 (18)-annulene- and formazan-copper complex dyes. Specific examples of suitable dyes are mentioned in EP-A 559 324, on page 4, lines 25 to 53. These are in particular triphenodioxazines, Bernacid Red 2BMN; Pontamine Brilliant Bond Blue A; Pontamine; Food Black 2; Carodirect Turquoise FBL Supra Conc. (Direct Blue 199), obtainable
25 from Carolina Color and Chemical; Special Fast Turquoise 8GL Liquid (Direct Blue 86), obtainable from Mobay Chemical; Intrabond Liquid Turquoise GLL (Direct Blue 86), obtainable from Crompton and Knowles; Cibracron Brilliant Red 38-A (Reactive Red 4), obtainable from Aldrich Chemical; Drimarene Brilliant Red X-2B
30 (Reactive Red 56), obtainable from Pylam, Inc.; Levafix Brilliant Red E-4B, obtainable from Mobay Chemical; Levafix Brilliant Red E-6BA, obtainable from Mobay Chemical; Procion Red H8B (Reactive Red 31), obtainable from ICI America; Pylam Certified D&C Red #28 (Acid Red 92), obtainable from Pylam; Direct Brill Pink B Ground
35 Crude, obtainable from Crompton & Knowles; Cartasol Gelb GTF, obtainable from Sandoz, Inc.; Tartrazine Extra Conc. (FD&C Gelb #5, Acid Yellow 23), obtainable from Sandoz; Carodirect Yellow RL

(Direct Yellow 86), obtainable from Carolina Color and Chemical; Cartasol Yellow GTF Liquid Special 110, obtainable from Sandoz, Inc.; D&C Yellow #10 (Acid Yellow 3), obtainable from Tricon; Yellow Shade 16948, obtainable from Tricon, Basacid Black X34, obtainable from BASF, Carta Black 2GT, obtainable from Sandoz, Inc.; Direct Brilliant Pink B (Crompton-Knolls); Kayanol Red 3BL (Nippon Kayaku Company); Levanol Brilliant Red 3BW (Mobay Chemical Company); Levaderm Lemon Yellow (Mobay Chemical Company); Spirit Fast Yellow 3G; Sirius Supra Yellow GD 167; Cartasol Brilliant Yellow 4GF (Sandoz); Pergasol Yellow CGP (Ciba-Geigy); Dermacarbon 2GT (Sandoz); Pyrazol Black BG (ICI); Morfast Black Conc A (Morton-Thiokol); Diazol Black RN Quad (ICI); Luxol Blue MBSN (Morton-Thiokol); Sevron Blue 5GMF (ICI); Basacid Blue 750 (BASF); Bernacid Red, obtainable from Berncolors, Poughkeepsie, NY; Pontamine Brilliant Bond Blue; Berncolor A.Y. 34; Telon Fast Yellow 4GL-175; BASF Basacid Black SE 0228; the Pro-Jet series obtainable from ICI, including Pro-Jet Gelb I (Direct Yellow 86), Pro-Jet Magenta I (Acid Red 249), Pro-Jet Cyan I (Direct Blue 199), Pro-Jet Schwarz I (Direct Black 168), Pro-Jet Yellow 1-G (Direct Yellow 132), Aminyl Brilliant Red F-B, obtainable from Sumitomo Chemical Co. (Japan), the Duasyn line of "salt-free" dyes obtainable from Hoechst, such as Duasyn Direct Schwarz HEF-SF (Direct Black 168), Duasyn Schwarz RL-SF (Reactive Black 31), Duasyn Direct Gelb 6G-SF VP216 (Direct Yellow 157), Duasyn Brilliant Gelb GL-SF VP220 (Reactive Yellow 37), Duasyn Acid Yellow XX-SF VP413 (Acid Yellow 23), Duasyn Brilliant Rot F3B-SF VP218 (Reactive Red 180), Duasyn Rhodamine B-SF VP353 (Acid Red 52), Duasyn Direct Türkisblau FRL-SF VP368 (Direct Blue 199), Duasyn Acid Blue AE-SF VP344 (Acid Blue 9), and the like, and mixtures of these dyes.

Further dyes can be used which contain or are based on pigments (dying or non-dying pigment), including pigments with metallic effect, or metals.

The concentration of the dye depends on the manufacturer and also on the color used and is not limiting for the present invention.

The dye solutions can moreover contain further additives, such as alcohol, thickeners, wet-strength agents, optical brighteners, preservatives, safety chemicals, binders and pigments (dyes or
5 non-dying pigments, like for example calcium carbonate). Auxiliaries for the dye solution are in particular gum arabic, polyacrylate salts, polymethacrylate salts, polyvinyl alcohols, hydroxypropylcellulose, hydroxyethylcellulose, polyvinylpyrrolidone, polyvinyl ether, starch, polysaccharides and the like.
10 Further customary additives for inks may likewise be present. Such customary additives are mentioned in EP-A 518 490, page 4, line 55, to page 5, line 9.

The process according to the invention is to be explained in more
15 detail below by the following examples, without it being intended to limit the invention to the embodiments described here.

Examples:

20 A paper having a basis weight of 105 g/m² is produced on a Fourdrinier machine. The paper stock composition consists of 80% by weight of softwood sulfate pulp and 20% by weight of eucalyptus sulfate pulp. The paper sizing is carried out using rosin size and alum. 1% of melamine/formaldehyde resin is used as the wet-
25 strength agent. The paper used in the example has no surface size.

The stated percentages of the nonfibrous additives are based on the fiber content. Sheets are taken from the paper thus produced, and desizing (example 1) or water-repellent (example 2) or both
30 (example 3) substances are applied in the form of handwritten characters to said sheets manually with the aid of an application apparatus, for example a Fineliner (Rotring Rapidograph 0.35 mm diameter), reed pen or brush. In example 4, a visible image is applied to the paper. The sheets treated in this manner are
35 colored by dipping in a dye solution, then pressed off with an absorptive paper mat and dried.

Example 1:

Application of a latent image using a desizing agent:

A 0.2% strength by weight aqueous solution of a polyether-modified trisiloxane (TEGOPREN 5847) is applied as described above to a paper sheet. The subsequent coloring is effected by dipping the paper sheet into a 1.0% strength by weight aqueous Cartasol Blau 3RF solution (Sandoz Chemikalien AG, Basle/Clariant (Deutschland) GmbH, Lörrach). The latent handwritten characters are very clearly visible and appear positive and in an intense hue in the same color in which the entire paper is colored.

10

The same experiment is repeated with another desizing agent, namely a di-n-octyl sulfosuccinate (DAPRO W 77, Krahn Chemie GmbH, Hamburg, Germany) and leads to the same satisfactory result.

15 Example 2:

Application of a latent image using a water repellent:

A 5.0% strength by weight aqueous dispersion of a polyethylene wax (SÜDRANOL 200) is applied as described above to a paper sheet. The subsequent coloring is effected by dipping the paper sheet into a 1.0% strength by weight aqueous Cartasol Blau 3RF solution (Sandoz Chemikalien AG, Basle/Clariant (Deutschland) GmbH, Lörrach). The latent handwritten characters are very clearly visible and appear negative and in a less intense hue in the same color in which the entire paper is colored.

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Example 3:

Simultaneous application of a latent image/pattern using both a water repellent and a desizing agent:

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A 0.2% strength by weight aqueous solution of a polyether-modified trisiloxane (TEGROPEN 5847, Goldschmidt AG, Essen, Germany) and a 5.0% strength by weight aqueous dispersion of a polyethylene wax (SÜDRANOL 200, Süddeutsche Emulsions-Chemie GmbH, Mannheim, Germany) are applied simultaneously, but not overlapping, as described above to a paper sheet. The subsequent coloring is effected by dipping into a 1.0% strength by weight Cartasol Blau 3RF solution (Sandoz Chemikalien AG, Basle/Clariant (Deutschland) GmbH, Lörrach). The latent handwritten characters are very clearly

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visible. They appear positive and in a more intense hue of the same color in which the entire paper is solidly colored, where the desizing agent was applied. They appear negative and in a less intense hue in the same color in which the entire paper is solidly colored, where the water repellent was applied.

Example 4:

Application of a visible image prior to tub coloring:

- 10 A blue inkjet imprint in the form of a net pattern is applied to a paper sheet by means of a commercial printer (Hewlett Packard DeskJet 870Cxi using the HP 51641A printer cartridge. The subsequent tub coloring of the printed paper sheet in a 1.0% strength by weight aqueous Cartasol Blau 3RF solution (Sandoz
- 15 Chemikalien AG, Basle/Clariant (Deutschland) GmbH, Lörrach) makes the imprinted pattern very clearly visible. The pattern appears positive and in a more intense hue in the same color in which the entire paper is colored.

Claims

1. A process for the production of nonuniformly intensely colored paper, comprising
 - a) application of at least one surfactant or a mixture of surfactants in the form of a latent image or pattern to paper,
 - b) coloring of the paper by means of a dye solution and
 - c) drying of the colored paper.
2. The process as claimed in claim 1, wherein the latent image or pattern is produced by applying the surfactant (mixture) by means of inkjet printing, offset printing, flexographic printing, gravure printing or printing by means of felt or rubber rollers, by spraying on or manually.
3. The process as claimed in claim 1 or 2, wherein the applied surfactant facilitates the penetration of water-soluble dyes into the paper.
4. The process as claimed in claim 1 or 2, wherein the applied surfactant reduces the penetration of water-soluble dyes into the paper.
5. The process as claimed in any of claims 1 to 4, wherein, in step a), both a surfactant which facilitates the penetration of water-soluble dyes into the paper and a surfactant which reduces the penetration of water-soluble dyes into the paper are applied.
6. The process as claimed in any of claims 1 to 5, wherein, in step a), the application is effected on a continuous paper web.
7. The process as claimed in any of claims 1 to 6, wherein an aqueous dye solution is used in step b).

8. The process as claimed in claim 7, wherein the coloring in step b) is carried out inside or outside the paper machine by applying dye solution(s) to the paper by means of classical paper coating apparatuses and methods, such as a size press, film press, knife coater, blade, rolls or spraying or by application of a dye solution to the total surface of the paper with the aid of suitable printing methods, such as inkjet printing, offset printing, flexographic printing, gravure printing or printing by means of felt or rubber rollers, or by spraying on or by tub coloring.
9. The process as claimed in any of claims 1 to 8, wherein the image or pattern is a diagram, a signet, a regular or irregular pattern, a net structure or any desired nonuniform color distribution.
10. A paper obtainable by one of the processes as claimed in any of claims 1 to 9.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 02/08404

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D21H27/02 //D21H21:24,21:28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 0 518 490 A (XEROX CORP) 16 December 1992 (1992-12-16) cited in the application the whole document ---	1-3,6-10
A	DE 581 032 C (I.G.FARBENINDUSTRIE) 22 July 1933 (1933-07-22) the whole document ---	1,3,4, 6-10
A	DE 580 903 C (I.G.FARBENINDUSTRIE) 18 July 1933 (1933-07-18) ---	
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

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- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- *&* document member of the same patent family

Date of the actual completion of the international search

21 November 2002

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Nestby, K

INTERNATIONAL SEARCH REPORT

International Application No

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